of fire to the contents of those vessels. The instance of the explosion, in 1864, of the *Lottie Sleigh* at Liverpool, laden with 11½ tons of gunpowder, in consequence of the accidental spilling and ignition of some paraffin oil in the cabin of the ship, illustrated the danger incurred in permitting these materials to be together on board a vessel, and should have furnished some warning by the publicity it received; but the explosion, ten years later, on the Regent's Park canal, of the barge *Tilbury*, revealed the continued prevalence of the same reckless disregard of all dictates of common prudence in dealing with the joint transport of explosives and volatile inflammable liquids.

The efficient laws and Government inspection to which all traffic in explosives has since then been subject, have rendered the recurrence of that identical kind of catastrophe almost out of the question, but an illustration has not been wanting quite recently of the fact that, but for the respect commanded by the rigour of the law, barges passing through towns would probably still carry freights composed of petroleum spirit and powder or other explosives, being at the same time provided with a stove, lamp, and matches for the convenient production of explosions. In August, 1883, an explosion occurred on the canal at Bath, in a barge which sank immediately, the master being slightly injured; the freight of the vessel consisted of petroleum, benzoline, and lucifer-matches.

The last four years have furnished several very remarkable illustrations of great injuries inflicted on ships by explosions, the origin of which was traced to the existence on board of only small quantities of some preparation containing petroleum spirit, or benzoline, with the nature of which the men who had charge of them were not properly acquainted. These materials had, consequently, been so dealt with as to become the means of filling more or less confined spaces in the ships with an explosive atmosphere which, when some portion of it reached a flame, was fired throughout, with violently destructive effects.

The first authenticated case of an accident due to this cause occurred in June, 1880, on board the Pacific Steam Navigation Company's steamer *Coquimbo*, shortly after her arrival in the morning at Valparaiso from Coquimbo. A violent explosion took place, without any warning or apparent cause, in the fore-peak of the vessel, blowing out several plates of the bow and doing other structural damage, besides killing the ship's carpenter; the explosion could only be accounted for by the circumstance that a small quantity of a benzoline preparation used for painting purposes (probably as "driers") was stored in the fore-peak and that a mixture of the vapour from this with the air had become ignited. The sufferer was the only person who could have thrown light upon the precise cause of the accident, but there was no other material whatever in that part of the ship to which the explosion could have been in any way ascribed.

In May, 1881, an explosion of a trifling character occurred on board H.M.S. *Cockatrice* in Sheerness Dockyard, in consequence of a man going into the store-room with a naked light and holding it close to a small can which was uncorked at the time, and which contained a preparation recently introduced into the naval service as a "driers" for use with paint, under the name of *Xerotine Siccative*. This preparation, which was of foreign origin, appears to have been adopted for use in the naval service and to have been issued to H.M.'s ships generally without any knowledge of its composition and without attention being directed to the fact that it consisted very largely of the most volatile petroleum spirit, which would evaporate freely if the liquid were exposed to air at ordinary temperatures, and the escape of which from a can, jar, or cask, placed in some confined and non-ventilated space, must speedily diffuse itself through the air, and render the latter more or less violently explosive.

When attention was directed to the highly inflammable character of this xerotine siccative by the slight accident referred to, official instructions were issued by the Admiralty, in June, 1881, to ships and dockyards that the preparation should be stored and treated with the same precautions as turpentine and other highly inflammable liquids or preparations.

The following November, however, telegraphic news was received of a very serious explosion on board H.M.S. *Triumph*, then stationed at Coquimbo, due to the xerotine siccative. The explosion took place early in the evening of November 23, and originated in one of the paint-rooms of the ship; the painter, and a marine who was assisting him, were in the upper paint-room at the time; the former received severe internal injuries and afterwards died, the latter was killed at once. One man standing at the open door of the sick bay furthest from the explosion was instantaneously killed, others in close proximity receiving only superficial injuries. Altogether there were two killed, two dangerously wounded—of whom one died—and six injured by the explosion.

The results of the official inquiry held at Callao led to the conclusion that the explosion was caused by the ignition of an explosive gas-mixture produced by xerotine siccative which had leaked from a tin kept in a compartment under the paint-room and quite at the bottom of the ship, usually termed the "glory hole;" that locality having been considered by the captain of the ship as the safest place in which to keep this material, to the dangerous nature of which his attention had been recently called by the receipt of the Admiralty Circular. It transpired that the painter had sent his assistant down to this compartment from the paint-room to fetch some paint. The man, who had a hand-lantern with him, while opening the hatch, which had not been opened for three days, made a remark that there was a horrible smell; the chief painter told him to return, as he thought the smell was due to foul air, and immediately afterwards the explosion occurred.

The tin can which had contained six gallons of the liquid was found, after the accident, to have received injury as though some heavy body had fallen, or been placed, upon it; this appeared to have been done before the explosion, and there is no doubt that the liquid had leaked out of the can, and had evaporated into the air in the compartment beneath the paint-room, and probably also to some extent in the adjoining spaces. The damage done was very considerable. An iron ladder leading from one paint-room to the other was so twisted up as to have lost all semblance of originality, the wooden bulkhead separating the upper paint-room and sick bay was completely blown away, the framing of the ship's side in the sick bay was blown inwards and broken, the furniture in the latter was completely shattered, and the bedding and clothes of the men near the explosion were much burned. The inquiries which followed upon this deplorable accident showed that, while due precautions were taken to store the supplies of mineral oil used for burning purposes, of turpentine and of spirit, which were sent to different naval stations for supply to the fleet, in special parts of the ship or on deck, this highly inflammable liquid, which was far more dangerous than other stores of this class, had been sent in freight-ships as common cargo, being stored in the hold without any precautions. A stone jar which was advised as containing a supply had arrived at its destination in the Pacific quite empty, the contents having leaked out and evaporated on the passage out, so that the vessel carrying it had been unsuspectedly exposed to very great danger.

(*To be continued.*)

PROGRAMME OF WORK TO BE PURSUED AT THE U.S. NAVAL OBSERVATORY AT WASHINGTON, D.C., DURING THE YEAR BEGINNING JANUARY 1, 1885[1]

The Great Equatorial

1. OBSERVATIONS of a selected list of double stars will be continued. These stars are such as have rapid orbital motions, or which present some other interesting peculiarity.

2. Conjunctions of the inner satellites of Saturn during the opposition of the planet will be observed. There will also be made a complete micrometrical measurement of the dimensions of the ring.

3. There will be made three drawings of Saturn—one before opposition; one at or near opposition; and one after opposition.

4. The observations which have been begun for stellar parallax, and for the temperature coefficient of the screw of the micrometer, will be finished.

The Transit Circle

1. Observations of the sun will be made whenever the necessary ephemeris stars can be observed, and the required instrumental corrections determined.

2. The moon will be observed through the whole lunation.

3. The major planets will be observed from fifteen to twenty times, near opposition.

[1] Transmitted by Commodore S. R. Franklin, U.S.N. Superintendent.

4. Each minor planet will be observed at least five times, near opposition, when practicable.

5. Observations of the list of miscellaneous stars will be finished as soon as practicable.

THE TRANSIT INSTRUMENT

1. Observations will be made as often as practicable for time, for the correction of the standard meantime clock ; and computations will be made daily for such correction.

2. Observations for the right ascensions of the sun, moon, and inner planets to be made as frequently as possible ; observations of the major planets, and of the brighter of the minor planets, to be made near opposition.

3. The observations made during 1883 will be prepared for publication ; and the computations of those of 1884 continued.

THE 9·6-INCH EQUATORIAL

Observations will be made :—

1. Of all the minor planets whose brightness at opposition is greater than their mean brightness.

2. Of comets, to determine position and physical peculiarities.

3. Of occultations of stars by the moon.

4. When arrangements shall have been made to photograph the sun, any sun-spots which show any decided peculiarities in the photographs will be examined with the spectroscope.

THE PRIME VERTICAL TRANSIT INSTRUMENT

Observations of a selected list of stars in conjunction with the Royal Observatory at Lisbon, in pursuance of the plan recommended by the International Geodetic Association, for the determination of variability of latitude.

TIME-SERVICE AND CHRONOMETERS

The time-balls at Washington and New York will be dropped daily at noon of the 75th meridian ; and the noon signals will be extended to such other places throughout the country as may be desirable, as rapidly as arrangements may be made.

The rating of chronometers will be continued as heretofore.

Meteorological observations will be made as usual.

THE MURAL CIRCLE

Observations will be made of stars down to the 7th magnitude south of ten degrees North declination, the positions of which have not been recently determined at some northern observatory ; the observing list to be formed of all stars from Gould's Uranometria Argentina visible here, and not found in Yarnall's Catalogue, the Transit Circle list of B.A.C. stars, or the recent Catalogue of the Glasgow Observatory.

SCIENTIFIC SERIALS

Rendiconti del Reale Istituto Lombardo, January 29.—On a special class of involutions of space known as monoidal, by Dr. V. Martinetti.—Analysis of the meteorological observations made at the Brera Observatory, Milan, during the year 1884, by E. Pini.—An experimental study of the thermic phenomena accompanying the formation of alloys, by Prof. Domenico Mazzotto.—On some eruptive rocks occurring between Lakes Maggiore and Orta, by Prof. Giuseppe Mercalli.—On the geometrical movement of invariable systems, by Prof. C. Formenti.—International right in connection with the proposed Italian penal code, by Prof. A. Buccellati.—Meteorological observations taken at the Brera Observatory during the month of January.

February 12.—On the psychological act of *attention* in the animal series, by E. T. Vignoli.—On S. Grimaldi's project of an agrarian credit as a remedy for existing evils among the agricultural classes in Italy, by P. Manfredi.—On a class of configurations of the third power, by Prof. G. Jung.—On the geometrical movement of invariable systems, by Prof. C. Formenti.—On an integer more general than that of living forces for the movement of a system of material points, by Dr. G. Pennacchietti.—Integration of the differential equation $\Delta^2 u = 0$ in some very simple planes, by Prof. G. Ascoli.

Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis, Dresden, 1884.—The organs of smell in the articulated animals, by Dr. Kraepelin.—An account of the Papuan inhabitants of Aru, Eastern Archipelago, communicated in a private letter to H. Engelhardt.—On *Anguillula radicicola*, a parasite infesting the coffee-plant on the Brazilian plantations, by B. Frank.—Phytological observations made on the flora of Dresden during the years 1883 and 1884, by A. Wobst.—On the morphology of the orchids, by Dr. O. Drude.—On the diluvial fauna of the Prohlis district, by Dr. Geinitz.—Remarks on some rare crystals of zircon and pyrites from Cornwall and Ontario, Canada, by A. Purgold.—On some archæological objects from Saxony, the Harz, and Italy, apparently connected with superstitious practices, by H. Wiechel.—On the chemical constitution of the colouring substance known as methylic blue, by Dr. R. Möhlau.—Memoir on new and little-known bird's eggs and nests from the Eastern Archipelago, specimens of which are possessed by the Dresden Zoological Museum, by A. B. Meyer.—On the latest geological researches in North America, by Dr. H. B. Geinitz. Remarks on the crepuscular phenomena observed in Europe and elsewhere at the end of the year 1883 and beginning of 1884, by Prof. G. A. Neubert.

Rivista Scientifico-Industriale, January 31.—Influence of static electricity on lightning conductors (concluded), by Prof. Eugenio Canestrini.—On the Westinghouse compressed air continuous brake, by the Editor.—Improved method of preserving ornithological specimens, by Dante Roster.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 5.—"On the Atomic Weight of Glucinum (Beryllium)." Second Paper. By T. S. Humpidge, Ph.D., B.Sc., Professor of Chemistry in the University College of Wales, Aberystwyth. Communicated by Prof. E. Frankland, F.R.S.

This paper is a continuation of one previously communicated to the Royal Society (*Proc. Roy. Soc.*, vol. xxxv. p. 137). The author has prepared a sample of metallic glucinum, having the composition—

Gl	99·20
GlO	0·70
Fe	0·20
	100·00

and has determined its specific heat at varying temperatures up to 450° with the following results (for pure glucinum) :—

c_{100}^{0}	0·4286
c_{175}^{12}	0·4515
c_{153}^{13}	0·4696
c_{240}^{15}	0·4885
c_{312}^{14}	0·5105
c_{360}^{14}	0·5199
c_{447}^{17}	0·5403

These results correspond to the following empirical formula for the true specific heat of the metal at varying temperatures—

$$k_t = k_0 + 2at + 3\beta t^2,$$

or with numerical values—

$$k_t = 0{\cdot}3756 + 0{\cdot}00106t - 0{\cdot}0000114t^2,$$

whence the following values for k_t are calculated :—

k_0	0·3756
k_{100}	0·4702
k_{200}	0·5420
k_{300}	0·5910
k_{400}	0·6172
k_{500}	0·6206

If these values are graphically represented the curve so obtained reaches a maximum at about 470°, and then falls ; but whether it represents the specific heat at higher temperatures than 500° is doubtful. The specific heat of glucinum thus rises rapidly up to about 400°, and remains approximately constant between 400° and 500° at 0·62. If this number is multiplied by 9·1 it gives the atomic heat 5·64. Glucinum, therefore, belongs to the same class as carbon, boron, and silicon, which agree with Dulong and Petit's rule at high temperatures only. And the true atomic weight is that required by the periodic law—viz. 9·1 and not 13·6, as was previously deduced from the specific heat between 10° and 100°.

This conclusion is confirmed by the author's determinations of the vapour-densities of glucinum chloride and bromide in a platinum vessel. The experiments were done in an atmosphere of carbonic acid collected over mercury after Meier and Crafts (*Berlin. Ber.*, xiii. 851), and gave the following results :—